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The Export Trade

The Board of Trade, through the Export Promotion Department (35, Old Queen Street London, S.W.1.), has decided to resume the publication of the Special Register Service of Information, which ceased to exist in 1941. The fee for the receipt of the information is £1 10s. 0d. per annum. This system of creating special lists for the receipt of information is the best that could be devised. At one time the Board of Trade broadcast notification of overseas enquiries, and these the FOUNDRY TRADE JOURNAL, in common with other business newspapers, listed under the heading "Contracts Open." This opened the field for intense competition, not only to the British, but also to foreign manufacturers. At one time it was thought that if such information were communicated privately to employer groups or to large firms there might be an outcry from a firm which had not received such information. However, with the system of the publication of a "Special Register Service," the chance is given for every firm to receive informaton simultaneously. The sole objection to the scheme is that it does tend to increase competition for any one contract. For instance, Jones and Company may have spent much time and money in cultivating the Ruritanian market for excavators, whilst Smith & Company's special field was Arcadia. Because Smith has not spent a penny piece cultivating Ruritania, an enquiry from that country may be a temptation to cut prices to get a foothold, whilst Jones feels just the same about Arcadia. Nevertheless, we believe that the Special Register system is the best any Government could devise.

By and large, the foundry industry is not of itself a great *direct* exporting industry, but it does *indirectly* make a very serious contribution. To ascertain the real facts is in most cases extremely difficult, and it is really interesting to see just how it works out in one particular case. John Harper & Company Limited, of Willenhall, amongst many other lines, make components for the typewriter trade. Actually, they employ 60 men in this section. With the object of showing their staff just what this means to the export and import trade, they have a show in their canteen designed to illustrate what happens to these components after despatch from the works. The wives and families are also invited to study the exhibit. The story is unfolded that British typewriter makers cater for a home demand of 400,000 machines per year, but, like most manufacturers, they have been asked to concentrate on exports. During the past year they have produced 303 tons of typewriters, valued at £391,140, for overseas markets. These exports, we are told, represent the complete rations of butter, tea, bacon and sugar for 7,040,520 persons for a week, or for 135,394 persons for a whole year.

Never has there been a better example in economics of how the *well-directed*—we emphasise this—efforts of 60 men can achieve such a worthwhile impact upon the standard of living of the population. It replaces in a most satisfactory manner the oft-times inane injunctions broadcast by means of slogans. We learn with interest that further sections of production are to be analysed and made the subject of future exhibitions. We congratulate John Harper & Company Limited on their pioneer effort and commend the system wholeheartedly to other enlightened manufacturers.

Contents

The Export Trade, 433.—The Institute's Conference (1948) Fund, 434.—Latest Foundry Statistics, 434.—The Engineering and Marine Exhibition, 1949, 434.—Forthcoming Events, 434.—The Constant-charge System of Cupola Operation, 435.—The Late Mr. T. Tyrie, 439.—Professors Visit Steelworks, 439.—British Industries Fair, 440.—Czechoslovakian International Foundry Congress, 440.—The Newcast Foundry, 441.—The Loam Moulding of Rope-Barrel Castings, 445.—Tonnage Oxygen Equipment, 448.—A Danish Centenary, 448.—Meeting Home Demands for Textile Machinery, 449.—Trade Agreement with Argentina, 449.—Electrical Industry's Output Progress, 449.—Consett Iron's Output Progress, 449.—Obituary, 450.—New Companies, 450.—Personal, 451.—Nickel Activities, 451.—Bridge Contract for Middlesbrough, 451.—Company News, 452.—Raw Material Markets, 454.—News in Brief, 454.

The Institute's London Conference (1948) Fund

First List

Mr. C. H. Kain, the honorary treasurer of the Fund being raised in connection with the forthcoming Conference of the Institute of British Foundrymen, has sent us for publication the first list of subscribers, as under:

Mond Nickel Company, £52 10s.; Ealing Park Foundry, £50; Lake & Elliot, Limited, £26 5s.; Wm. Jacks & Company, £25; Britannia Iron & Steel Works, Limited, £25; Ransomes, Sims & Jeffries, £25; J. & E. Hall, £25; B. Levy & Company, £20; Stone Wallwork, Limited, £20; Dover Engineering Works, Limited, £15 15s.; Crane, Limited, £10 10s.; Booth & Brookes, Limited, £10 10s.; R. & A. Main, Limited, £10 10s.; K. & L. Steelfounders, £10 10s.; Enfield Foundry Company, Limited £10; Belling & Company, Limited, £10; Marco Conveyor & Engineering Company, Limited, £5 5s.; A. Cohen & Company, Limited, £5 5s.; Renshaw Foundry Company, £5 5s.; Mallory Metallurgical Products, £5 5s.; G. D. Peters & Company, Limited, £5 5s.; the Borough Engineering Works, Limited, £5 5s.; Climax Molybdenum, £5 5s.; Elliot Bros. (London), Limited, £5 5s.; Mr. E. H. Salinger, £5 5s.; Tyseley Metal Works, Limited, £5 5s.; C. V. A. Jigs & Tools, £5 5s.; Broads Manufacturing Company, Limited, £5 5s.; John Every (Lewes), Limited, £5 5s.; Victor Moyle & Company, £5; Dexter & Company (High Wycombe), Limited, £5; Peter Brotherhood, Limited, £5; Penton Publishing Company, Limited, £5; Manganese Bronze & Brass Company, Limited, £5; Wingets, Limited, £3 3s.; Walter Wilder & Sons, Limited, £3 3s.; Langley Alloys, Limited, £3 3s.; Croydon Foundry, Limited, £3 3s.; Mr. A. C. Turner, £3 3s.; Cronite Foundry Company, Limited, £3 3s.; Allen & Simmonds, £2 2s.; Mr. F. J. Barraball, £2 2s.; B. B. Kent, Limited, £2 2s.; Mr. W. Pyatt, £2 2s.; Mr. L. E. Slater, £2 2s.; the Glacier Metal Company, Limited, £2 2s.; Taylor's Foundry, £2 2s.; Mr. K. J. Edwards, £2 2s.; Mr. F. J. Skinner, £2 2s.; Knete Castings, Limited, £2 2s.; Mr. D. Carrick, £2 2s.; Geo. Kent, Limited, £2 2s.; Seagers, Limited, £2 2s.; Mather & Smith, Limited, £2 2s.; Reavell & Company, Limited, £2 2s.; Highton & Son, Limited, £2 2s.; H. & E. Lintott, Limited, £2 2s.; Davis Gas Stove Company, Limited, £2 2s.; Cocksedge & Company, Limited, £2 2s.; International Alloys, Limited, £2 2s.; Mr. A. L. Ladeveze, £2; Mr. S. Kay, £2; Mr. R. G. Hanson, £1 1s.; R. Hunt & Company, Limited, £1 1s.; Northampton Foundry Company £1 1s.; Field Foundry Management, £1 1s.; Millar's Machinery Company, Limited, £1 1s.; Corn Products, Limited, £1 1s.; Mr. A. J. Henbrey, £1 1s.; H. G. Sommerfield, Limited, £1 1s.; Mr. L. Elliott, £1; Mr. K. W. Belcher, 10s. 6d.; Mr. S. Bojarczuk, 10s.; Mr. G. Swinyard, 5s., and Mr. A. G. Evans, 5s. Total, £532 18s. 6d.

AT THE Annual General Meeting of the Birmingham Branch of the Institute of British Foundrymen on April 28, Mr. E. R. Dunning was elected Honorary Secretary and Treasurer.

Latest Foundry Statistics

The April Bulletin of the British Federation of Iron and Steel Manufacturers gives the total number of those engaged in ironfoundries for the week ending February 7 as 148,918, of whom 139,077 were men. This shows an increase during January of 5,166, of which number 4,709 were males and 457 females. The increase on the year has been 14,886—well over 10 per cent. Conversely, employment in the steelfoundry has receded. The total number employed was 19,087 in February, 1947, 18,880 in January, 1948, and 18,855 in February of this year. The decrease during the year is of the order of 232 persons of whom 55 were females. In March, the steelfounders melted 7,600 tons, as against 8,200 in February and 6,800 in March, 1947.

The Engineering and Marine Exhibition, 1949

Such was the success of the 1947 Engineering and Marine Exhibition that the organisers, Messrs. F. W. Bridges & Sons, Limited, announce that they have now been able to secure the whole of Olympia for their next Exhibition, which will be held from August 25 to September 10, 1949. The increasing effectiveness and popularity of this exhibition has determined this policy, together with the fact that a large number of would-be exhibitors were precluded from the 1947 exhibition owing to the lack of space available in spite of the use on that occasion of the National Hall and its galleries in addition to the Main Hall and its annexe. The bookings already received from old exhibitors are very heavy, but the addition of the Empire Hall will make possible the acceptance of a certain number of exhibitors if application be made reasonably early.

Forthcoming Events

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

Institution of Production Engineers.

MAY 11.

Wolverhampton Graduate Section:—"Fine Measurement," by L. Wilcox, M.Sc., at the Wolverhampton and Staffordshire Technical College, Wolverhampton, at 7.15 p.m.

MAY 12.

Wolverhampton Section:—"Metallurgical Factors Influencing Machinability," by L. W. Johnson, at the Wisemore Schools, Walsall, at 7 p.m.

MAY 12 and 13.

British Ceramic Society.

Refractory Materials Section:—Spring Meeting at Newcastle upon-Tyne. Morning Sessions at 10 a.m. at the Institute of Mining and Mechanical Engineers, Neville Hall, Westgate Road. Papers:—"Some Investigations into Coring of Fireclay Refractories," by K. W. Cowling and A. Elliot; "Some Remarks on the Spalling of Fireclay," by C. E. Moore; and "The Behaviour of Firebricks on Reheating," by J. F. Clements, B.Sc., A.R.I.C. Works' visits to Consett Iron Company, Limited, and to the Foster Firebrick Works.

The Constant-charge System of Cupola Operation*

Base Cupola Metal Modified by Spout Additions to suit a Range of Castings

By W. W. Braidwood

The cupola is still the most faithful servant of the iron-founding industry. Its advantages include:—(1) moderate initial outlay; (2) low cost per ton of metal melted; (3) simplicity of operation; (4) ready utilisation of steel scrap; and (5) continuous melting.

The last-named attribute, however, is sometimes associated with considerable disadvantage. Unless elaborate and expensive measures be adopted it is impossible to obtain really sharp separation of successive irons, and the best that can normally be expected is a gradation from the characteristics of the one to those of the other. For that reason the wise operator strives to arrange his programme so as to avoid abrupt changes from charge to charge.

Moulding and closing schedules cannot, however, always be synchronised with the most suitable arrangement of cupola charges, and even when this is practicable and a satisfactory programme has been devised and put into operation, the situation is fraught with danger. In the best-regulated foundries, cores may be damaged or insufficiently dried, there may be trouble or delay in closing important moulds, mechanical breakdowns may occur—indeed any of the mishaps to which foundries are prone may disrupt or wreck the most intelligently-planned programme.

Considerable disorder, delay, and loss of equanimity can then result. It may be necessary to put off the blast—with adverse effects on the subsequent performance of the cupola and on shop costs if the foundry is kept waiting. It may be necessary to pour metal down and put extra charges on later, or to use hardly-suitable metal for important castings. Foundry foremen and metallurgists experienced in the production of iron castings of good quality are familiar with happenings of the type outlined, and many must have longed to operate an arrangement by which:—(*a*) all of the charges placed in the cupola could be of standard composition, and (*b*) the tapped metal could be modified at will to suit the range of shop- and service-requirements.

Such a procedure would make the work of the cupola men quite straightforward and would give complete elasticity of arrangement on the foundry floor. Such a procedure is entirely possible! It is the purpose of this Paper to outline the guiding principles, to discuss operational details, and to make specific recommendations.

* Presented to the East Midlands Branch of the Institute of British Foundrymen and elsewhere.

The Standard Charge System

The essential features of the process are exactly as stated in (*a*) and (*b*) above. The standard charge is so constituted as to yield, at the cupola spout, an iron of constant composition, which, by the addition of suitable materials in practicable amounts, can be so modified in chilling characteristics, etc., as to suit the whole range of castings normally produced in the foundry concerned.

It might be made clear at this point that the system is not applicable to all foundries. Those specialising in the production of castings for building trade and allied users are not likely to be interested in the procedure about to be described. Such foundries, indeed, most usually already operate single-mixture systems, using charges high in phosphorus and silicon to suit the lightest sections involved.

Neither is it suggested that the procedure could successfully be applied, without adjustment, to a foundry producing castings ranging from, say, heavy hydraulic equipment to very light-section structural parts. Such a disparity, however, is rarely found in a single shop and, where it does exist, modification of the technique, so as to give two separate base irons for subsequent treatment, can meet such special needs.

The type of foundry to which the proposed system is applicable most readily and with maximum benefit is

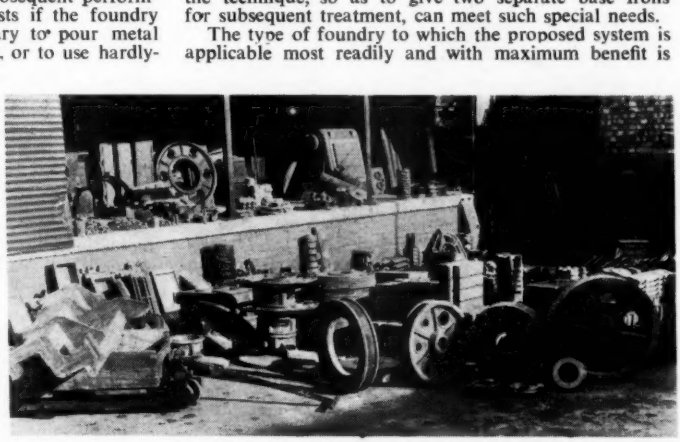

FIG. 1.—A CORNER OF THE DESPATCHING BAY AT RENSHAW FOUNDRY.

The Constant-charge Operation System

that required to produce engineering castings to meet the requirements of B.S. Specification No. 786, Grades 2, 3, and 4, of sections ranging from 4 in. downwards, of structural and pressure types, unmachined and extensively machined. The system is of particular advantage in foundries of the mechanised type, with large outputs of a variety of such castings. Figs. 1 to 4 show typical castings produced by foundries operating the constant-charge system.

The Charge

In computing the charge, considerations of final chemical composition are of first importance. These are dealt with below under the separate headings of the normal constituent elements.

Carbon.—Should be maintained neither so low as to be liable to give foundry difficulties by reason of poor fluidity, pronounced shrinkage, *etc.*, nor so high as seriously to endanger the mechanical properties of the finished castings. The preferred range is 3.0 to 3.3 per cent., and the charges should be composed with this aim constantly in view.

Silicon.—Since it is the intention to use silicon-containing and other graphitising materials as spout- and ladle-additions, the silicon content of the as-tapped metal should be low, 1.0 to 2.0 per cent., depending on the range of castings concerned. The recommended procedure is to adopt a charge which will give the silicon content required in the heaviest-section castings normally produced. Guidance in this matter is given in Table I.

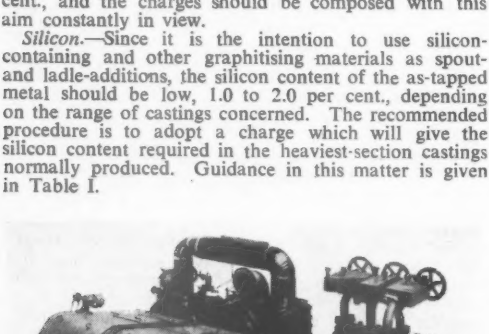

FIG. 2.—HORIZONTAL SINGLE-ACTING MARINE-TYPE CO_2 COMPRESSOR.

Test pressure—3,000 lbs. per sq. in. hydraulic or 1,500 lbs. per sq. in. air.

The castings used range in weight from 7½ tons to 2 lbs. (high pressure and low pressure steam cylinders, condenser end covers, guide plates, valves, valve covers, etc., made in alloyed cast iron).

(Courtesy of J. & E. Hall, Ltd.)

TABLE I.—*Silicon Content Related to Section Thickness.*

Average section of heaviest castings in regular production in ins.	Recommended silicon percentage of as-tapped metal.
4	1.0 to 1.2
3	1.1 „ 1.3
2	1.2 „ 1.4
1	1.4 „ 1.6
½	1.6 „ 2.0

Since section thickness is not always an accurate representation of cooling rate, and since chilling characteristics, *etc.*, are influenced by factors other than silicon content, the above table should be regarded as a rough guide only. The relatively low silicon content of the as-tapped metal is of particular advantage in the case of pressure castings, since dense, sound, machinable structures are most readily ensured by keeping silicon low and using graphitising additions of nickel.

Manganese.—Should be maintained within the limits 0.6 to 1.0 per cent.

Sulphur.—Should not, normally, exceed 0.12 per cent. When a particularly low sulphur is necessary for any special purpose, de-sulphurisation may be effected, preferably in a suitable type of receiver.

Phosphorus.—In cast iron, forms a eutectic which freezes at about 950 deg. C., and thus increases the range of temperature over which solidification takes place. This effect, coupled with the presence of appreciable proportions of the phosphide eutectic, promotes inter-dendritic shrinkage. The critical phosphorus content varies indirectly with carbon and silicon and, in cast iron of the type already specified, the upper limit is approximately 0.4 per cent. Since it is the aim of this procedure to produce particularly sound castings with good mechanical properties, phosphorus should never be allowed to exceed the stated figure and should preferably be held to a maximum of 0.25 per cent. Where molybdenum-containing irons are scheduled, the phosphorus content should be as low as is practicable.

Other Elements.—No consideration is to be given at this stage to nickel, chromium, or molybdenum contents, because the procedure covers addition of these alloys, as required, at the spout or in the ladle. Since the separate grades of returned scrap are distributed as uniformly as possible over the total charge, the as-tapped metal will normally contain small percentages of the alloys in regular use. The general level of quality is thereby raised and the necessary fresh additions are reduced.

In those instances in which the bulk of the output is required to be of particularly good quality, *e.g.*, where pressure castings are in the majority, use may be made of a nickel cast iron throughout. In such cases the nickel content of the base iron is maintained by charging "F" Nickel ingot or nickel-bearing pig-iron, at the lowest figure desired in any grade, extra nickel being provided as required by spout or ladle addition.

Planning the Charge

In planning the charge, consideration must also be given to the physical characteristics of the constituent materials. Generally speaking, and especially in the

case of foundries required to produce extensively-machined, pressure-tight castings, use should preferably be made of finer-grade pig-irons of the following types:—(*a*) Low-phosphorus refined irons produced by re-melting methods; (*b*) low-phosphorus blast-furnace pig of the machine-cast or of the finer-grained sand-cast grades; and (*c*) hematite pig of the machine-cast type. Where the use of coarse-structured pig is unavoidable, then the steel scrap content of the charge should be kept towards the higher end of the range later recommended. Normally, pig-iron will represent from 40 to 50 per cent. of the total charge.

Full use should be made of shop scrap, the separate grades being distributed as uniformly as possible throughout the successive charges so as to give the maximum constancy of composition at the tap hole. Shop returns will account for between 20 and 40 per cent. of the weight of metal melted. Because of its heterogeneous nature and generally high phosphoric composition, no use should be made of miscellaneous purchased scrap. In exceptional instances, for example, where worn-out castings of known, suitable, and reliable composition are available, such material may successfully be utilised in proportions up to 20 per cent. of the charge.

Steel scrap should be charged to the greatest extent *practicable*. The italicised term is the operative word, and the amount usable in any instance is controlled by:—the nature of the materials which form the balance of the charge; the precise final carbon content desired; the mechanical properties demanded; and the degree of uniformity required from tap to tap. The practicable upper limit may be set at 40 per cent., the normal range being 10 to 30 per cent. Emphasis must be laid on the absolute necessity for satisfactory physical condition. A short cut to trouble in the foundry is the use in the cupola charge of light-section, oversize, rusted, or heavily-scaled steel scrap in substantial amount, and it cannot too often be repeated that steel scrap for cupola remelting should be reasonably free from rust and scale; not under ¼ in. nor over 3 in. thick; no piece longer than half the diameter of the cupola or greater in area than one-tenth that of the cupola cross-section. Short rail or beam croppings, railway fishplates, *etc.*, are ideal. Other materials such as 14 per cent. silicon pig, lump ferro-silicon, lump ferro-manganese, silicon or manganese briquettes, etc., can be charged as required.

It may be contended that the ban on the use of phosphoric pig-irons and miscellaneous purchased cast iron scrap will cause the charge to be relatively expensive. A useful comparison of cost is provided in Table II:—

It is seen that the superior charge costs only about 10s. per ton more than that for the normal type of phosphoric iron.

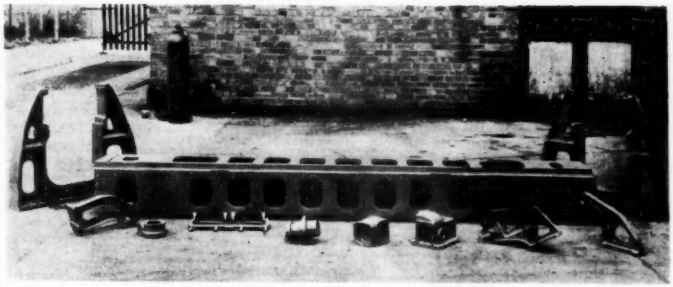

FIG. 3.—GROUP OF TEXTILE CASTINGS. WEIGHT, 16 CWTS. 14 LBS.
(Courtesy of Lloyds (Burton), Ltd.)

TABLE II.—*Relative Costs of Normal and Recommended Procedures.*

	Per cent.	Price per ton.	Cost.
Norman charge for Phosphoric Cast Iron:		s. d.	£ s. d
No. 3 foundry pig iron	40	188 3	3 15 4
Miscellaneous cast iron scrap ..	30	98 6	1 9 7
Shop return scrap*	30	98 6	1 9 7
Total cost per ton of charge:—			6 14 6
Typical charge for recommended procedure:			
Refined pig iron	25	224 6	2 16 2
Low-phos. pig iron	25	195 6	1 19 1
Steel scrap	20	78 0	0 19 6
Shop return scrap*	30	98 6	1 9 7
Total cost per ton of charge:—			7 4 4

All costs as for Birmingham district, December, 1947.
* Taken at ruling price for cast-iron scrap.

It is only fair, however, to include the cost of spout additions of silicon. An increment of 0.5 per cent. silicon, which is probably above the average, would cost:—

(*a*) When using granulated ferro-silicon (75 per cent. Si—£40 per ton): 5s. 4d. per ton of metal treated.

(*b*) When using "Sil-X" (45 per cent. "available Si"): 8s. 10d. per ton of metal treated.

No note need be taken of the costs of the normal alloying additions, *e.g.*, nickel, chromium and molybdenum since these are the same, whatever be the composition of the metal to which the additions are made.

In recent years many advances have been made in the development of materials for addition to molten cast iron, particularly of exothermic compounds which make it possible to add graphitising and alloying materials without appreciable reduction of temperature, and of low-melting-point alloys which are capable of ready and complete solution. These developments have greatly widened the field of ladle treatment and have greatly helped to make the constant-charge system a practicable proposition.

The materials most commonly in use as graphitisers are: Ferro-silicon—usually of the 75 per cent. silicon

The Constant-charge Operation System

grade; silicon metal—commercially pure; calcium silicide; and various exothermic compounds sold under proprietary names. Of the materials in the last group the best known is probably "Sil-X," which contains powdered ferro-silicon intimately mixed with sodium nitrate. A small proportion of the ferro-silicon is "reactive," *i.e.*, it is consumed in the heat-giving reaction; the remainder is "available" for solution in the molten cast iron.

Large-scale use is made of "F" nickel shot for simultaneous alloying and graphitising of good-quality cast irons. This 92 per cent. nickel, 5 to 6 per cent. silicon material melts at a temperature of 1,250 deg. C., and is readily soluble in molten cast iron. A recent development is the production of a nickel-silicon alloy containing 60 per cent. nickel with 30 per cent. silicon, the balance of the composition being mainly iron. This material, known as "F" nickel, Type B, is a eutectic alloy which, with a melting point temperature of only 980 deg. C., is rapidly and completely soluble in molten cast iron. It is supplied in the form of shot, which by reason of its high specific gravity readily penetrates the metal surface. It diffuses rapidly and leaves no surface scum. It is a potent inoculant and a particularly convenient material for use when a simultaneously alloying and strongly graphitising addition is required. "F" nickel, Type B, has recently become commercially available in Britain.

An indication of the respective efficiencies of the inoculants already mentioned is given in Fig. 5. The sand-cast wedges and the chilled blocks depicted were poured under constant conditions, from crucible melts each designed to have the following nominal final composition: C, 3.0; Si, 1.3; Mn, 0.7; and Ni, 1.2 per cent. Wedge (*a*) was poured without treatment, the others being inoculated one minute before pouring, by addition of the materials listed, in amounts such as to give increments of 0.5 per cent. silicon. (An exception had to be made in the case of the low-silicon "F" nickel shot,, in which instance the addition was limited to the amount which would give 1.2 per cent. nickel, the necessary extra silicon being added with the charge.) Graphite added in lump or in flake form is another effective inoculant, especially favoured when silicon increase is undesirable.

Alloying Materials

"F" nickel shot is the most effective material for addition of nickel to molten cast iron and, as shown in Fig. 5, it is also a graphitiser. "Type B" nickel-silicon provides a satisfactory and convenient means of adding nickel, while simultaneously inoculating the iron very effectively. It is of particular advantage in ensuring machinability in very light sections. For addition of chromium to the tapped metal, use may be made of granulated ferro-chromium, but the exothermic compound "Chrom-X" is preferred. Molybdenum is usually added in the form of granulated ferro-molybdenum. There are available, however, proprietary exothermic materials containing molybdenum.

In planning additions it must always be remembered that 2 per cent. by weight represents the maximum addition of cold non-exothermic material which can be made to cupola-melted cast iron without serious loss of temperature. By pre-heating the material to a bright red, additions equalling 3 per cent. or more may successfully be made. Nevertheless, in such instances it is preferable to use, to some extent at least, exothermic compounds of proved efficiency. Even when the required addition be relatively small it is often advisable to use a suitable heat-giving compound, especially if light-section castings are to be poured.

Methods of Addition

"F" nickel and "type B" shot should be added in a steady shower to the stream of metal in the spout. The addition should be commenced only when the bottom of the ladle has been covered and should be completed by the time that two-thirds of the required weight of metal has been tapped. Ferro-silicon, ferro-chromium and ferro-molybdenum should be free from dust and granulated to pass a ¼ in. mesh. These materials also should be added as detailed above.

In handling all of these materials, employment of a suitable hopper and delivery arrangement is an advantage, though such equipment is not essential. Perfectly satisfactory results are obtainable by properly-made manual additions. The exothermic compounds should be added as recommended by the respective

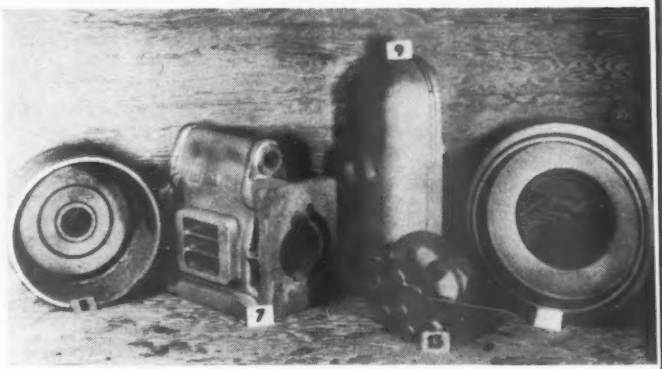

FIG. 4.—GROUP OF CASTINGS FOR DIESEL-DRIVEN TRACTOR.

(5) Driving pulley, 157 lbs. (unalloyed). (9) Radiator heater 154 lbs. (unalloyed).
(7) Cylinder 228 lbs. (1 per cent. nickel). (11) Brake drum 92 lbs. (1 per cent. nickel).
(13) Cylinder head 52 lbs. (1 per cent. nickel).

(Courtesy of John Fowler (Leeds), Ltd.)

TABLE III.—*Recommended Cupola Practice.*

Dia. of cupola at melting zone.	Height—Tuyeres to sill.	Unit charges.			Air supply.			Melting rate per hour.	
		Coke.	Limestone.	Metal.	Volume.	Pressure.		Minimum.	Preferred.
In.	Ft.	Lb.	Lb.	Cwt.	Cu. ft./min.	Ozs./sq. in.	In. W.G.	Cwt.	Cwt.
24	10	28	4–6	2–2½	1,250 app.	8	13.7	40	48
30	12	42	6–9	3–3½	1,875 ,,	9	15.5	60	72
36	14	56	8–12	4–5	2,800 ,,	10	17.3	90	108
42	16	84	12–18	6–7½	3,750 ,,	11	19.0	120	144
48	18	112	16–24	8–10	5,000 ,,	12	20.9	160	192
54	20	149	20–30	10–12½	6,250 ,,	13	22.7	200	240

manufacturers. Usually the material may be put in the ladle prior to tapping; added to the metal in the ladle; or sprinkled on to the stream of metal in the spout.

Graphite, whether in lump or in flake form, should be placed on the clean surface of the metal in the ladle.

Skimming Procedure

Additions of "F" nickel and of "type B" shot leave no residue on the metal surface. "Type B" shot is dissolved with particular readiness, and for this reason is of especial value in the treatment of small quantities of metal, *e.g.*, the contents of hand-ladles. Alloy addition by means of properly-granulated ferro-chromium and ferro-molybdenum is a fairly clean procedure. When ferro-silicon is used, however, a cindery dross usually results, and this is especially the case when calcium-silicide is employed. Such deposits, however, can be skimmed off fairly readily.

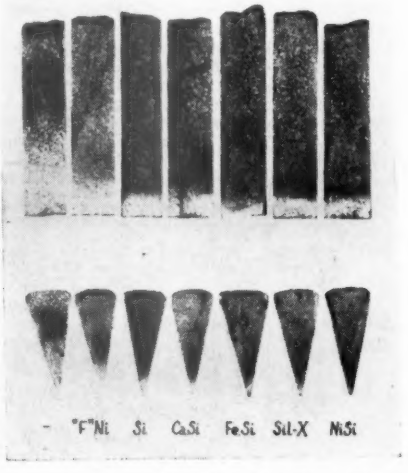

FIG. 5.—WEDGE AND CHILL BLOCK TEST PIECES FROM IDENTICAL MELTS, DIFFERENTLY INOCULATED.

Exothermic compounds usually generate slags which are best dealt with by scattering dry sand over the surface of the metal. This thickens the slag, which can then be skimmed off or held back from the pouring lip.

(*To be continued.*)

The Late Mr. T. Tyrie

Mr. John Bell has sent us the following memoire of Mr. Thomas Tyrie, B.Sc., whose death was reported to the last Council Meeting of the Institute of British Foundrymen. Mr. Tyrie was born in Kilmarnock, and started work in the laboratories of Glenfield & Kennedy, Limited. He left this firm in 1937 to take up a position with Walter MacFarlane & Company, Limited, Saracen Foundry, Glasgow, and the following year he joined the British Cast Iron Research Association, taking charge of their laboratory in Falkirk, and dealing with the Scottish business of the Association. He became a member of the Institute of British Foundrymen in 1929, and after serving a term as President of the Falkirk Section of the Institute, he was appointed President of the Scottish Branch in 1944. He died on April 2, 1948, after an illness that had lasted for about three years. He leaves a widow and a young daughter of five years of age. Mr. Tyrie was very highly respected in Scotland, both by members of the Institute and by the foundry trade, for the quiet air of efficiency and the readiness with which he met all requests for help in meeting and solving problems in the foundry.

Professors Visit Steelworks

The United Steel Companies, Limited, recently invited fourteen Professors of Mechanical Engineering from eleven different universities to visit their works in Sheffield and Scunthorpe. The visit, which lasted four days (April 12 to 15), was designed to help bridge the gap between industry and the universities by giving the university men an opportunity of seeing the special problems of the steel industry and the steel men the chance of discussing with the professors the latest ideas on engineering. Discussions were arranged on the dependence of metallurgical developments on engineering research, with particular reference to such problems as the handling of scrap and the flow of gases in open-hearth furnaces. A discussion on industrial research was opened by Sir Charles Goodeve, F.R.S., Director of the British Iron and Steel Research Association.

British Industries Fair

The British Industries Fair opened last Monday at Castle Bromwich, Birmingham, and at Olympia and White City, London. It is, naturally, the stands of the heavy industries, which are located at the Birmingham section, which are of greatest interest to foundrymen, though, strangely, core-oils are exhibited at the London section. There are this year twenty-six miles of stands, covering nearly 23 acres, and some of the well-known foundry equipment and foundry materials manufacturers are exhibiting. Of great interest, too, are those stands of founders who also produce finished goods, for here are afforded opportunities for foundry-minded visitors to weigh the relative merits of the castings which often comprise the major part of their wares. It is difficult to assess just what tonnage of castings is on view at the Fair, but it is certainly no less than usual, and the quality is well up to standard. It might fairly be added, however, that light-alloy castings are well to the fore; a considerable number of manufacturers seem to have turned to light castings as a result of difficulty in securing iron.

The Fair is open at Birmingham to trade buyers and the general public every day from 10 a.m. to 6 p.m., but at London the general public will only be admitted on Wednesdays, May 5 and 12, and Saturday, May 8; it closes on Sunday, May 9, and, finally, on May 14. A feature of the Birmingham section, which is this year retained, is the Workers' Day, on the first Saturday, when parties of workers from the factories of the exhibitors are invited. There are, among the official visits, those of the Engineers' Associations on May 5; the British Non-ferrous Metals Federation on May 12; and the Engineering and Allied Employers' Association on May 13.

MR. P. JAMBULINGUM, of Southern Industries, 32, Sembudoss Street, Madras, India, is to start up a new foundry.

Book Review

Partners and the Law. By P. Elman, Barrister-at-Law. Published by Stevens & Sons, Limited, 119 & 120, Chancery Lane, London, W.C.2. Price 4s. net.

Most legal books are as dry as dust to the lay mind, but this one is an exception. Actually, it is so readable that one almost forgets the passage of time. After all, in the majority of cases, partnerships are between small tradesmen and merchants, and the variety of their make-up is large. That is why the book is so interesting. For instance, it seems that if there are twenty partners in a concern, they must, if they desire to take in another partner, become a limited liability company. Then again, if a partner advances money beyond the agreed amount of the capital, he is entitled to interest at 5 per cent. So one can go adding to one's knowledge of a subject bristling with difficulties and pitfalls. Those of our readers who are already in a partnership business or intend embarking on such an enterprise would do well to consult this little book.

V. C. F.

Czechoslovakian International Foundry Congress

The Institute of British Foundrymen will not participate in the forthcoming International Conference scheduled to take place in September in Prague. No official exchange Paper will be sent and the presentation of individual technical contributions will be discouraged.

The Da Vinci Plaque

We must have misread the last issue of "The Stantonian," for it states that the original was made in the early years of the 19th century by Windsor Furnace, Pennsylvania, U.S.A., and a casting found its way to Stanton to be used as a pattern. We thank Mr. S. Wood, editor of "The Stantonian," for drawing our attention to this.

THIS EXHIBITION, STAGED BY JOHN HARPER & COMPANY, LIMITED, IS COMMENTED UPON IN THIS WEEK'S EDITORIAL.

The Newcast Foundry

From Foundations to Production in less than four months

By A. R. Parkes

This is the story of a quite small foundry which has been built since the war in what is probably record time. It is now producing quantities of machine-tool castings to help overcome a national shortage. Because this foundry has so quickly got into production and is an example of what can still be done by private enterprise even in these difficult days, it is deemed noteworthy to describe the steps which led to its creation, to detail its make-up and to say something also of its personnel and of the *esprit de corps* which permeates the undertaking.

The Conception of the Scheme

A new foundry to-day does not come into being solely because somebody thinks it would be nice to have a foundry and afterwards looks around for jobs to take on. Usually the reverse is the case, *i.e.*, there is a need in a consumer firm or industry for more or better castings and the new foundry is created to supply that need. So it was with Newcast Foundries, Limited. The parent firm, Victoria Machine Tool Company, Limited, in common with many in the same line, urgently needed more machine-tool castings. Their needs were not those that just any foundry could supply and their existing suppliers could not increase production. After trying abroad and in many other places, they finally (against the advice of many who said the project was untimely) decided to erect a foundry to relieve their supply "bottle-necks."

A site in North Staffordshire was selected after considerable early disappointment; it was a five-acre open field on the edge of the Potteries, with a road running alongside. Fortunately, high-tension electric cables cut across the corner and water supplies and other services were not too far away. A licence to build and equip was applied for in November, 1946, and granted in December of that same year. This bald statement covers a vast amount of "spade" work by the two men in charge of the project. In their modesty they acknowledge a lot of help from the local town clerk, and the regional panel in Birmingham. It was passed as a scheme within the £5,000 limit, which had to include the site, its preparation, all buildings, plant and equipment; in fact, every item of capital expenditure. The superficial area of the first main foundry building was about 5,000 sq. ft.

Birth of the New Foundry

On March 18, 1947, snow was being cleared away from the virgin site in order to begin the roadway entrance and the foundations in readiness for the steel erectors. The first weeks were full of pioneer effort; the ground was at one time hard with frost; at other times trenches were filled first with snow and later with water, but the work went on apace and the small nucleus made up of skilled moulders, a coremaker or two and a few handymen, soon saw growing the 100-ft. by 42-ft. by 30-ft. high skeleton of the steel and asbestos main building shown in Figs. 1 and 2. A plan of the foundry layout is shown in Fig. 3.

Some idea of the speed with which jobs were put through may be obtained from the time required for the building, wiring-up and bringing into use of the sub-station from the 6,600-volt overhead electric line; five days were taken for this building and five only for the wiring-up—a district record. Prior to this, current for portable drills and the like had been "borrowed" from a helpful neighbour. The first cast was made on June 30, just over three months after the first day's work on the site. At the end of July a month's production was celebrated at a party in the "local." In December, 1947, production totalled 250 tons of machine-tool castings and a second party was held, this time in the newly-completed canteen. To-day production averages 70 tons per month and increases are foreshadowed as the foundry practice becomes more and more established and as extensions, shown in dotted outline in Fig. 3, are brought into being.

Operational Details

The foundry is of the jobbing variety, for this is the type of production most suited to the large and complicated castings for the machine-tool trade, especially when capital expenditure is so limited. Such limitation has also curtailed any attempt at mechanisation of the moulding operation, though ancillary operations and transport have been developed on a flow-production basis.

FIG. 1.—ERECTION OF THE FOUNDRY BUILDINGS (APRIL, 1947).

The Newcast Foundry

Sand Preparation.—After the site had been roofed and drained and the surface removed, the foundry floor was made up with 75 tons of Swynnerton red sand, 50 tons of Southport silica sand and 30 cwt. of bentonite. In the early days there was trouble due to scabbed castings and this, strangely, was not cured until a very high dilution of facing sand with floor sand and reclaimed knock-out sand was introduced. A typical facing sand now runs as follows:—200 lb. floor sand, 25 lb. red sand, 25 lb. reclaimed knock-out sand (mostly from cores), 12 lb. bentonite, 10 lb. coal dust, and ½ pint of core oil. This is milled in a "Polford" mill of 5-cwt. capacity. It took three months to get the floor sand into really good condition; two "Royers" are now used for its regular rejuvenating treatment. The core sand (most of the castings are heavily cored) also contains some loam for increased green and dry strength, a normal mixture being as follows:—150 lb. Southport, 25 lb. red sand, 10 lb. proprietary semi-solid and ½ pint core oil. Cores are blacked with a plumbago-base dressing. All silica sand is dried for core-making and for this purpose extremely efficient improvisation has been used for the sand drier, shown in principle in Fig. 4, this again with a view to restricting capital expenditure.

Metal Supply.—Staffordshire cylinder, and Derbyshire pig irons are used, to the total of about 33¼ per cent., in the metal mixture for the cupola; the balance being made up of shop returns and machine-tool scrap. The maintaining of the supply of pig iron and coke has provided one of the biggest headaches for the management up to the present time—supplies arriving always in a "hand-to-mouth" fashion. There are two cupolas, both purchased in the second-hand market, and both of the solid-bottom type. The larger, with a hearth diameter of about 33 in., is used at a melting rate of 4 tons per hour on four afternoons per week. The smaller (hearth diameter 22 in.) is used on the remaining afternoon; this one has a melting rate of about 2½ tons per hour. About 2½ per cent. of nickel is added to the cupola charge in the form of nickel-copper-alloy ingots. At the cupola spout a proprietary flux is used in the ratio of 3 lb. to each 25 cwts. of molten metal, after which the metal is skimmed. Occasionally ferro-manganese is also added at the spout. A 30-cwt. ladle is used for pouring most jobs, and is combined with one of 20-cwt. capacity for casting the larger jobs. There are two 2-ton capacity overhead travelling cranes.

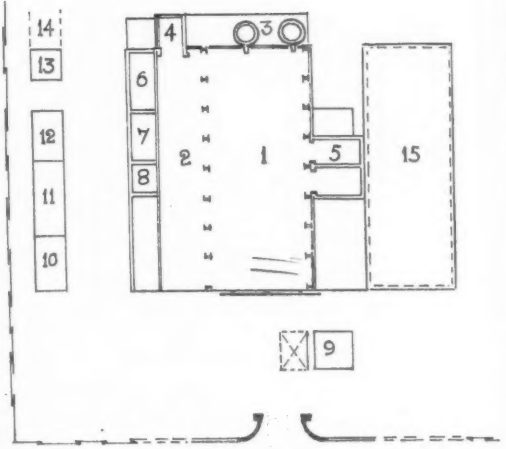

FIG. 3.—PLAN OF THE FOUNDRY LAYOUT.

(1) Main foundry bay.
(2) Core shop.
(3) Cupolas.
(4) Core oven.
(5) Mould ovens.
(6) Sand storage.
(7) Sand mixing.
(8) Compressor house.
(9) Weighbridge.
(10) Office.
(11) Canteen.
(12) Pattern store.
(13) Lavatories.
(14) Proposed site for bathing facilities, etc.
(15) Proposed new foundry bay.

FIG. 2.—NEWCAST FOUNDRY (APRIL, 1948).

Moulding.—Floor moulding in dry sand is the rule, as practically all the jobs are of the machine-tool type, carrying complicated and massive cores and having a wide variety of design. A few jobs are best suited to loam moulding, and in these cases the major part of the brickwork is saved for repeat castings. Box-parts are mainly of cast iron made to suit the patterns handled regularly. For these regular lines the mould top-part is fully dried in stoves while the bottom-part is skin dried *in situ* with a "Polford" portable coke-fired drier. The stoves for mould drying and the core drying are coke

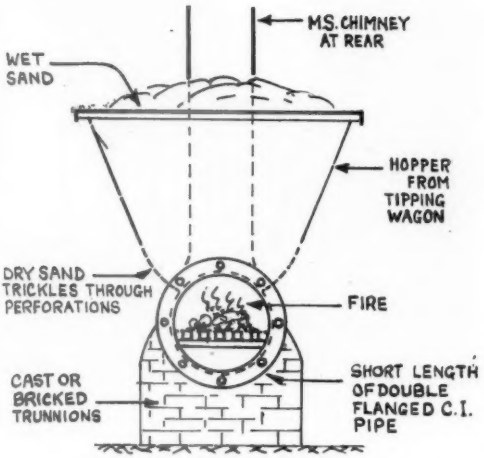

FIG. 4.—IMPROVISED SAND DRIER.

fired, are external to the main building and are made to the firm's own design. Those for moulds are 20 ft. by 9 ft.; there are two of these, while the core stove has 12 ft. by 9 ft. floor space. A general view inside the foundry is shown in Fig. 5.

Chilling is extensively used to give a Brinell hardness of 200 minimum on certain machined faces of the castings. An interesting point in this connection is the fact that chills are not used more than twice; this has been proved a worth-while precaution. Before use they are coated with a plumbago wash. Cast-on tensile bars regularly give 15 to 17 tons tensile, and written commendation was shown to the writer from well-known machine-tool makers regarding the soundness, dimensional accuracy and good machinability of the castings.

Orthodox running methods are adopted, usually with bottom ingates, and hot metal additions are made to risers as necessary. Exothermic feeding flux is used on risers, and the principles of directional solidification are observed in the designing of each running, risering and chilling system. No particular trouble is reported to be caused by camber or cooling distortion, although certain jobs are cored-out so as to equalise contraction by the early removal of the cores after casting. Cores are checked dimensionally before being passed on to the moulders, so that no "rubbing" is necessary.

Fettling and Despatch.—Once again, capital limitations have prevented the purchase of elaborate equipment. There is no shot-blast, but the castings strip so cleanly from the sand that little dressing is necessary. Such chipping and grinding as is required is done mainly by portable tools. Each casting is carefully inspected before despatch, and at one time foundry rejections at seven per cent. were considered to be high. Most of the defects, however, were due to inexperience on the part of some of the moulders new to this class of work, and the writer was assured that rejections are now below 5 per cent.

The exit doors of the main foundry are large enough to permit the loading of castings on to lorry by one of the travelling cranes, as shown in Fig. 6.

Typical Jobs Handled.—The heaviest job which has so far been tackled is a Mixer End-frame casting weighing 2¼ tons destined for a tyre factory. This, however, is not reckoned as of major interest from the moulding point of view as there is little intricate work involved, although the main metal section is quite heavy, it being about 14 in. square. For the same customer, tyre-mould ring castings are made. A job which gave satisfaction to moulders and customer alike is a column casting for a well-known machine tool firm. This casting, shown being lifted in Fig. 7, although weighing only 1½ tons, is 7 ft. 6 in. long and of box design, about 18 in. wide and 24 in. deep. Patterns for most of the jobs are supplied by the customers, and pattern work at Newcast is at present confined to minor repairs.

Personnel

It will have become obvious from the foregoing that for a new foundry to have made such a flying start there must be team work and *esprit de corps* among management and men of a very high order. That spirit was made manifest to the writer in all his contacts at the works. It is impossible to pick out individuals for special mention, but tribute must be paid to that hardy

FIG. 5.—GENERAL VIEW INSIDE THE FOUNDRY.

The Newcast Foundry

band who so willingly forgot for a time that they were skilled moulders and gave a hand with the navvying work. That the seventy-odd employees at Newcast are a happy crowd goes without saying, it is written in their attitudes—they know they are doing a good job, they are proud of their work, have confidence in the management, and their wage packets reflect their industry. A further contributory reason for their satisfaction may be found in the canteen, where 60 meals per day are served and, as the writer can testify, they are both well cooked and substantial.

As regards actual manning, there are now some thirty skilled moulders, ten core-makers (including four women), ten fettlers, and three furnace men engaged on direct production jobs. A group bonus system based on tonnage is in operation, together with an individual good-timekeeping bonus. A small night shift is engaged chiefly for extra moulding.

Amenities

Apart from the canteen, showers, baths, and a recreation room are planned, while leisure time can also be filled on the football field, which will still be left free even when the immediate extensions are completed.

Training Plans

Although there is as yet no official apprenticeship scheme, there is working a system of training and improvership. Plans for a Group Training Scheme are awaiting co-operation from other foundries in the district. Another interesting feature is that of the interchange of personnel with their customers. Two members of the team at Newcast spend a day (all expenses paid) with the Victoria Machine Tool Company, Limited. A reciprocal pair from the machinist firm visit Newcast to see how the castings are made; it is an arrangement which has already paid good dividends.

A further clause proposed for apprenticeship provides that each trainee shall spend six months with the parent machinist firm.

FIG. 6.—LOADING CASTINGS FOR DESPATCH BY ROAD TRANSPORT.

FIG. 7.—FETTLING AND CLEANING SECTION.

Conclusion

This foundry has not been selected for a report because it shows the last word in mechanisation nor yet because the present amenities are of the highest order. Rather it is that, starting from zero, its erection to-day in so short a time and its present high output and general well-being is an epic achievement of which all may be proud. That some equipment and plant is referred to as secondhand or improvised is chiefly a sign of the times; nowhere has efficiency or the quality of product been impaired. To use the words of Mr. C. Reynolds, one of the directors of Newcast, "It is the willingness to get on with the job, whatever the job may be, that so obviously makes all the difference between rapid progress and continual delay. We can, if only we will get down to it, beat anyone in the world, and it seems a great shame that this spirit is not more widespread."

Finally the writer thanks the staff of Newcast, and particularly Mr. Reynolds and his co-director Mr. Lewis, for the interesting time he spent at their foundry.

MR. H. H. SHEPHERD, well known in malleable-iron-foundry circles, is sailing for Australia on May 21 to join the staff of the Lister, Blackstone Proprietary, Limited, St. Peters, Sydney, N.S.W.

The Loam Moulding of Rope-Barrel Castings*

Concluding the account of the making of 20-ton castings and Discussion

By D. Robertson

(*Continued from page* 418.)

Method of Running

Two runner boxes were made, approximately 12 in. wide, with a shaped pouring basin to the design on Fig. 13; the shape being built up in an open-sand mould. The prods were made in the usual way, to a total height of 12 in., and six 4-in. dia. holes arranged to correspond with the six runners on each side. These were bricked up and coated with loam by hand; two loam-cakes were inserted at a point immediately in front of each set of down-gates and dried in a stove. These loam-cakes or slag-traps as they were called, were built-in so that a 3-in. gap 12 in. long was left under them, and this allowed only sufficient metal to pass under to maintain the runner basin at its maximum level as well as to feed the three 1½ in. dia. down-gates. At the first rush of metal from the ladle the basin between the two slag-traps was flooded and any dirt which may have entered the pouring basin floated to the top and only the clean metal passed underneath the slag trap to the down-gates.

A layer of soft loam was spread round each down-gate at the top plate, keeping it about 3 in. from the holes, and the runner basins were bedded down firmly, wooden git-pegs were placed in the down-gates and the larger holes in the basin were rammed firmly with good facing-sand and sleeked smoothly before withdrawing the wooden pegs, then a light coating of thin blacking was added and a hot brick was placed on each down-gate to dry it off.

The second basin was made up in the same way and two riser basins made up as shown in Fig. 13. A trough lined with sand led from the flow-off to a sand bed where proper pigs were moulded to receive the metal which was run off, and ugly lumps of metal were thus avoided.

Weighting and Pouring

Two 2-ton weights and a 4-ton ingot were placed on top of the mould and the job was then ready for pouring.

Two 10-ton capacity ladles, each holding 9 tons of metal, were used for pouring; plugs were placed over the down-gates so that the runner basin could fairly slowly be filled to the top quietly and without the undue rushing, which often results in splashing and serious burns. The two extreme plugs on each runner basin were withdrawn first and pouring continued until it was decided that the step at the bottom of the mould had been covered, when all the remaining plugs were removed and pouring was speeded up. This precaution was taken to avoid excessive impingement on the bottom of the mould, and to so allow for some progressive solidification, by a reduction in the temperature of the metal which flowed under the bottom cores and around the heavy central boss, at a slower rate than was usual.

When the level of the metal in the mould reached the flow-off, the casting proper was complete and about one ton of metal was run through. The flow-off was then botted up and a fresh 5-ton ladle of metal was brought along and the feeding head filled up with nice hot metal. Pouring was stopped when the level of the metal reached the runner basins, as there was no need to fill them up and have needless chunks of metal to get rid of.

Easing the Mould after Casting

About one hour after casting the bolts were eased slightly and the steel packing pieces between each core-plate were removed; then the mould was cleaned round, the weights and runner basins were removed from the top, all the wedges and boxes round the inside bolts were removed, and the eight inside bolts were slackened as well as the outside bolts.

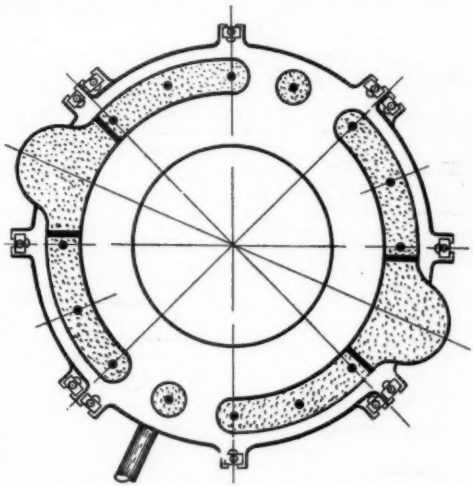

FIG. 13.—PLAN OF TOP OF MOULD, SHOWING POURING BASINS.

* A Paper read before the Bristol and West of England Branch of the Institute of British Foundrymen, Mr. H. E. E. Holladay, B.Sc., presiding.

Loam Moulding of Rope-Barrel Castings

The packing pieces between the columns and the tapered easing-blocks were removed, and by striking the wedges shown on Fig. 8 the easing blocks were withdrawn, and the light overhanging grid then exposed was easily broken, and since the packing under the grid was all soft loam, this left three 2-in. gaps all the way down the inside of the casting, and the risk of cracking by contraction was entirely eliminated. All this was completed in two hours from the time of casting.

The reason for the double lugs on the top plate now becomes evident, for, as the four large bolts were removed and then the four small bolts, it left four intermediate bolts binding all the rings to the bottom plate, so that when the casting was removed the setting of the brickwork was not disturbed and many hours were saved in the moulding of subsequent castings.

Construction of Mould for the End Cover

Sweeping the bottom of the cover was done in the orthodox manner, using the same type of proddered plate and a 3½-in. spindle as shown in Fig. 14. After sweeping the mould, a frame core-box was set in position to strike-off the lightening cores. The weight of the bottom plate was about five tons. Because of the head on top of the centre boss there was a deep lift in the top plate, and, as well as having prods around the outside, there were formed also three inner rows, cast to a pre-determined taper. The total weight of the top plate was 6 tons. The spindle was set through a wooden boss which was jointed in the middle on account of the two tapers, and one half was withdrawn upwards from the mould after it was swept up, and the other half through the bottom after removal of the loose centre.

The space between the prods was well filled with ashes and dried loam cake up to the level of the rows of prods, when a series of light segmental grids were laid on top of the prods and bolted through to the top plate and the whole allowed to stiffen before proceeding further. Spaces were arranged in these grids to take the eight ribs. This then brought the work to within sweeping distance of the strickles, and this operation was then completed, the bosses were withdrawn, and the two halves put in the stove.

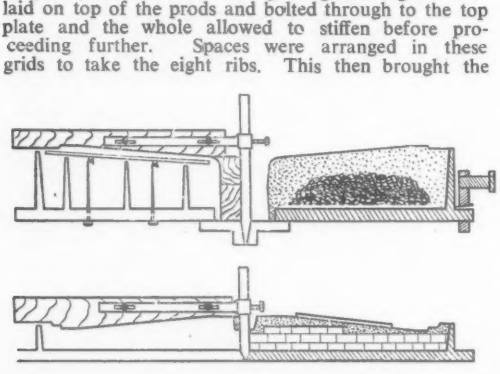

FIG. 14.—CONSTRUCTION OF THE MOULD FOR THE END-COVER CASTING.

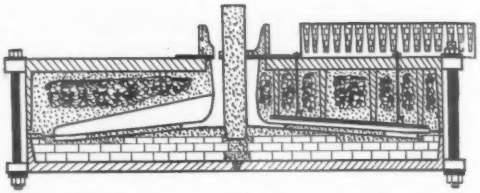

FIG. 15.—SECTION THROUGH FINISHED MOULD FOR THE END-COVER CASTING.

When blacked-off and dried, the job was closed as shown in Fig. 15, the top part being turned over on the loose journals shown in Fig. 14, which were wedged to two opposite lugs. The height was governed to keep the weight on a level central with the journals, so that there was no jerking or sudden turning over as is usually experienced in turning over work which is top-heavy. The two halves of the mould matched themselves by the guides, which were swept on each joint. They were bolted down with the eight 1¼-in. dia. bolts which had been previously used on the main barrel casting. The same runner basin was used, to serve six 1-in. dia. down-gates evenly spaced over one half of the casting about 12 in. up from the flange and just under the lightening cores.

The centre core was placed in position and held by means of a cake-core which had the necessary hole for the core to pass through and a run-off from the feeding head. This was firmly secured and a riser bush was made up; full details are shown in Fig. 15. Pouring was carried out with two tons of metal and, as each of the six down-gates was closed by a plug, the runner basin was filled to the top before the two outside plugs were withdrawn. The mould was poured slowly with these two runners until the bottom flange was filled and the metal in the mould had risen to the height of the point of contact of the down-gates. At this stage all the remaining plugs were withdrawn and the pouring was completed at a much faster rate.

Material Handling Data

The pouring temperature for the top cover was approximately 1,300 deg. C.; the casting time was about 25 secs., and the weight of the casting 25 cwts. The temperature of the metal in the ladle for the barrel casting was 1,280 deg. C., the total pouring time up to the flow-off was about 90 secs., and the job took almost 21 tons of metal.

The composition of the metal in the castings was as follows:—T.C, 3.0 to 3.2; Si, 1.3 to 1.6; Mn, 0.6 to 0.9; S, 0.12 (max.), and P, 0.5 (max.) per cent. The metal was melted in two 42-in. dia. cupolas which delivered approximately 6 tons 10 cwts. per hr. About 46 tons of tackle were used in the job and the total weight of four sets of castings was 88½ tons.

In calculating the weight of the bricks and loam in the main cores, etc., it was assumed that 5 per cent. of the total volume of these cores is taken up by core plates and grids and that the remainder is made up of 75 per cent. brickwork at 132 lb. per cub. ft. and 25 per cent. loam at 100 lb. per cub. ft.; therefore, the approximate weights are as below:—

	t.	c.	q.	lb.
Wt. of bottom core	3	0	0	0
,, two intermediate cores	5	10	0	0
,, top core	2	5	0	0
	10	15	0	0

Holding Down the Mould*

Therefore, the total deadweight, resisting the upward lift of the metal, was about 27 tons 5 cwts., and as the total upward thrust of the metal was 270 tons, approximately, provision had to be made to resist an upward thrust of 243 tons. Working out the strength of holding-down bolts was carried out in the following manner:—

1¾ in. dia. Whitworth bolt (black)
Root dia. of thread .. .. .. = 1.49 in.
Root area .. .. .. = 1.74 sq. in.
Maximum tensile load of bolt .. = 28 × 2,240 × 1.74 lbs.
= 109,000 lbs.
= 48 tons.

Eight Bolts. 48 × 8 = 384 tons

By the same method, eight 1¼-in. dia. bolts have a total resistance of 272 tons; total resistance of 16 bolts, 656 tons; safety factor of 2, 328 tons.

The margin of safety is therefore 60 tons (approx.), but without the use of a flow-off before the metal reached the top of the mould, this would not be too secure, as, with the pouring of two ladles simultaneously there is a sudden momentary lift as the mould is filled, which causes an enormous pressure on the mould, and which makes it necessary to keep this wide safety margin. It is also advisable to maintain this safety precaution even with a flow-off, because this might get choked up or the metal might be too sluggish to flow through, with the result that the maximum pressure would be exerted on the top plate.

The weights were put in the centre of the top plate to prevent any buckling, as all the pressure of the holding-down bolts was exerted on the perimeter of the top plate. On such large diameters this precaution should always be taken.

Moulding Materials

The "roughing" or building loam used consisted of 60 to 70 shovels of Erith loam sand and five shovels of manure, while the sweeping loam consisted of 60 shovels of floor sand, 15 shovels of Erith loam, and seven shovels of manure. Both sands were milled for about 20 min. in a pug-mill. The oil-sand for the lightening cores was mixed in a pug-mill and was made up as follows:—14 shovels of sea sand, not necessarily dried, and three 2-pint tins of a well-known brand of core-binder. The blacking used was No. 10 prepared blacking made by a high-grade manufacturer.

* The calculations for the prevention of the lifting of the mould are, in our opinion, open to criticism and should not too literally be applied to other jobs.—Editor.

DISCUSSION

MR. H. E. E. HOLLADAY, chairman, thanked Mr. Robertson for a very interesting and instructive talk, and said that whilst loam moulding was carried out on a smaller scale in his district, he was amazed at the foresight necessary to produce a mould of this calibre, as each step had to be thought-out beforehand and put into operation smoothly and efficiently so as not to impede work in progress.

MR. A. JACKSON said that he was very interested to learn that a much stronger loam was used for building purposes than that used for final sweeping; was that a common practice?

MR. ROBERTSON replied that it was good practice on a job of this sort to use a good strong building loam; more so, since the brickwork had to last for four castings. Also, a loam with such a high clay content, if used for sweeping, was liable to produce large surface cracks when dried. A loam with a lower clay content, but sufficiently strong to stand up to the wash of the metal, was more open and allowed the steam to escape when drying, did not crack so readily and produced a better finish.

MR. MCCULLOCH said that when he had a cracked mould and had filled the cracks in, the finished casting still had lines or rat-tails over the surface which corresponded to the cracks before they were filled in. Had Mr. Robertson ever come across this and, if so, how had he remedied it?

MR. ROBERTSON said that, when a crack was filled in, only the top surface was usually filled, which left an air cavity at the root of the crack. In his opinion, the ridges were formed by a momentary expansion of this air which bulged the newly stemmed loam slightly before escaping through the brickwork. The only way to stop it was either to dig the crack right out to the brickwork and completely stem in, leaving no gaps, or to use a building loam sufficiently high in permeability to allow the air to escape more easily.

MR. W. JACKSON asked if Mr. Robertson had ever tried sawdust to cope with this fault and to induce greater permeability.

MR. ROBERTSON replied that he had used sawdust to a certain extent, but had not achieved sufficiently good results to warrant a continuation of its use; also, he found it extremely difficult to obtain supplies of fine sawdust, and preferred to use manure or tow, or bull's wool or cow-hair, according to the district.

MR. W. JACKSON said that his experience with sawdust, which was generally coarse, was that it produced marked castings.

MR. A. JACKSON asked how the Author calculated the downgates for the job in question.

MR. ROBERTSON said that this was done mainly from experience, as it was very difficult to work to a calculation as the temperature and fluidity of the metal had to be taken into consideration, and these were very difficult to define beforehand. Furthermore, it was his opinion that if runners were calculated according to normal standards of mathematics and the limited knowledge of the behaviour of molten metal, the subsequent result would indicate such small runners as to be instantly condemned as impracticable. The calculation

Loam Moulding of Rope-Barrel Castings

carried out was the area of the gap under the slag trap core against the combined areas of the downgates.

MR. BALME, referring to the method by which Mr. Robertson estimated the stress on the top plate, said that the results were amazing. He also noted Mr. Robertson's remarks of progressive solidification with regard to the bottom boss; was this proved sound on machining? Also, he noted how the head of the main casting was topped-up with hot metal; why was not the same precaution taken with the head on the cover?

MR. ROBERTSON said that he did not intend to enter into argument about the why's and wherefore's of progressive solidification, as there were varied opinions on this subject; but what he aimed at was simply to get metal of a lower temperature into the heavy boss than that of the surrounding thinner sections to induce the whole to set at the same time. This policy was proved on machining the boss, which was perfectly sound and no draws or shrinkage cracks were visible.

The head on the cover was not topped up because of the higher pouring temperature and the faster pouring time; thus the metal in the head was warm enough to feed the casting properly according to all the isothermic principles. This was also proved to be sound policy when the head was removed.

MR. POTTS said that he was pleased he had not missed this lecture, as it was well worth coming all the way from Chippenham to hear; the only regret he had was that he had not heard this Paper many years ago, when he and Mr. Hares were working together in making a large loam casting which gave them many a headache. But, with the knowledge he had now gained about easing such a casting to allow for contraction, he could face the job with a much easier mind.. With regard to the plugs used over the downgates, what shape did Mr. Robertson prefer and what were they made of?

MR. ROBERTSON replied that the plugs he preferred were egg-shaped, so that they fitted round the edge of the downgates, and there was then no danger of the edge of a dried runner basin crumbling. The plugs were of cast iron, coated with a liberal thickness of loam or slurry.

MR. HAYWARD asked how long the job stood in the mould before stripping and what dressing was used on the mould.

MR. ROBERTSON said that the job was arranged to be cast every second Friday and the casting was left from the Friday to the Tuesday before being removed from the mould. He used a high-carbon blacking for dressing the mould.

MR. A. JACKSON asked why Mr. Robertson did not use half-binders, as it would then not have been necessary to remove the sweeps to try each binder in position. Also, was there any ovalness perceived in the casting at the open end?

MR. ROBERTSON said that in a job of this weight he preferred to use complete binders, as the time taken in removing the sweeps was small, and this had only to be done in the preliminary building and the position was static for subsequent castings. There was no ovalness on this casting, as the stresses were uniform, but on other castings of a more complicated nature, some distortion had been apparent.

After further questions, a vote of thanks was proposed by MR. KINGDOM, in which he spoke for all the members present in conveying his deepest gratitude to Mr. Robertson for a very pleasant and enlightening afternoon. Since they did no work of this size in their local foundries, he said the talk was a revelation to them of the preliminary work and thought required in making the tackle for a job of this description. The vote of thanks was seconded by Mr. Evans, and the meeting duly endorsed the proposition with acclamation.

Tonnage Oxygen Equipment

Steelfounders using side-blown converters are showing considerable interest in the oxygen-enrichment of the blast for increasing output. At least one foundry in Britain is already using this technique on a production basis. The main deterrents to the wider application of oxygen in this way are the cost and supply considerations; oxygen has to be purchased in the liquid form and evaporated on the premises. The French company, *L'Air Liquide Soc. An.* of 75, Quai D'Orsay, Paris, is now manufacturing the "Oxyton" plant for producing medium-purity oxygen on a tonnage scale for use on site in industry. The smallest plant envisaged is for the production of about 30 tons of oxygen per day; a medium plant may produce about 200 tons per day, and large installations up to 800 or 1,000 tons per day. An "Oxyton" plant was described in our sister journal, "Iron and Coal Trades Review," on April 9. This plant, destined for the Dutch State Mines, is for producing 100 metric tons per day of oxygen at 92 per cent. purity, using three units in parallel, and utilising power at the rate of 340 kw.-hrs. per ton of oxygen. This works out at 0.53 kw.-hrs. per cub. m. of 100 per cent. oxygen. The French firm is represented in Britain by Peroxide Development, Limited, 2, Caxton Street, London, S.W.1.

A Danish Centenary

Ribe Jernstoberi (Ribe Ironfoundry) have issued an exquisite brochure for the purpose of publicising their existence in the Danish town of Ribe for one hundred years. Letterpress tells of the continuous development under enlightened management during this period, whilst photographs, some beautifully coloured, show the present appearance of shops and offices. A major production is that of radiator segments, and in this connection it is interesting to see illustrated the consolidation of sand by a double-handled roller moving along a frame superimposed upon the moulding box. The reviewer adds his congratulations to the many the firm must already have received.

THE MODEL 5400 film comparator-densitometer is a new instrument announced by Applied Research Laboratories, 4336, San Fernando Road, Glendale 4, California, for making comparisons with master films and obtaining transmission readings of spectrum lines photographed on 35-mm. spectrum analysis film.

Meeting Home Demands for Textile Machinery

T.M.M.'s Position

"As regards orders, I should explain that the ratio of export to home sales is agreed with the Board of Trade, having regard to the heavy demand for exports and the needs of the home market," says Mr. Kenneth H. Preston, chairman of Textile Machinery Makers, Limited, in a statement circulated with the accounts. "Apart from further contracts for machinery for export, we can reasonably expect substantial orders for cotton machinery from the home market now that the Cotton Spinning (Re-equipment Subsidy) Bill has passed its second reading in the House of Commons. In order to qualify for the subsidy under this Bill, mills must place their orders before the end of April, 1949, and the machines must be delivered prior to the end of April, 1952. The Cotton Board have provided us with a schedule of the new machines and conversions which it is anticipated will be required, and we have advised the Board—after consultation with Tweedales & Smalley (1920), Limited—that the suggested programme is generally within our joint potential capacity, although, if the programme becomes effective *in toto*, it would appear to involve extension of our existing manufacturing arrangements."

Mr. Preston goes on to state that he has no hesitation in saying that if their home customers place their orders immediately, their requirements—as sent to the Cotton Board—can be met, and the machines and conversions produced and delivered within the specified period. "I would stress," he says, "that there are only four years left for us in which to complete this programme. Every month of delay in placing orders makes it more difficult for us to fulfil our undertaking, and delay in ordering may mean that the machines will not be delivered in time to qualify for the Government subsidy." In view of the fact that public money is involved, they have readily accepted that prices for machinery for the home market for the next four years shall be agreed with the Government, and from time to time consultation will take place with the Ministry with a view to adjusting the various prices up or down as the then prevailing conditions justify.

In common with other industries, they have been set an export target to achieve by the end of 1948. Their particular target, while it is high, is by no means impossible of attainment. Mr. Preston points out that during the last quarter of 1947 they exceeded the sighting target for June, 1948. Their current raw material position is reasonably satisfactory, but they need to increase their labour force.

MARSHALL, SONS & COMPANY, LIMITED, engineers, engine and boiler manufacturers, etc., of Gainsborough, is planning to celebrate its centenary this year by giving a small park in the centre of the town. In addition, a sports ground and pavilion will be provided for the company's employees.

Trade Agreement with Argentina

The text of the agreement on trade and payments between the Government of the United Kingdom and the Government of the Argentine Republic, concluded in February last, has been published by H.M. Stationery Office (Cmd. 7346, price 2d.).

The agreement contains two schedules, one of which gives details of the products to be supplied by the United Kingdom during the current year. These include:—Coal, 1 million tons; steel (finished and semi-finished products), 75,000 tons, of specifications and types to be agreed; steel spans for bridges, 2,300 tons; stainless steel, 50 tons; tinplate 34,000 tons; zinc sheets, 2,000 tons; tin (subject to allocation by the Combined Tin Committee), 1,000 tons; agricultural machinery and implements, 10,000 tons, and cutlery, 100 tons.

It is provided in the agreement that purchase and sale of these goods are to be effected through the customary channels of trade.

Electrical Industry's Output Progress

The annual report of the British Electrical and Allied Manufacturers' Association, presented at the recent annual meeting in London, showed that the association had had another very busy year. Mr. E. C. Holroyde, vice-chairman of the Council, who presided in the absence abroad of the chairman, Sir George Nelson, said that, in spite of the many difficulties that had had to be faced, the industry had succeeded in raising its production to a volume exceeding that of 1938, and there was every prospect of it being able to meet the new export targets, as well as going a long way towards satisfying the urgent home needs.

Sir George Nelson and Mr. E. C. Holroyde were unanimously re-elected chairman and vice-chairman respectively for the next session.

Consett Iron's Output Progress

The new 20-ft. dia. hearth blast furnace, No. 3, of the Consett Iron Company, Limited, recently produced 5,154 tons of basic pig-iron in a week. This is a national record and is also believed to be a European record for this size of furnace.

The record output—said to be 8 per cent. higher than that recently claimed by the Steel Company of Wales, Limited—was achieved from a furnace started last October. The furnace is fully mechanised. An official of the company described the output as "a tremendous achievement."

CIBA, LIMITED, a Swiss concern, has acquired a controlling interest in Aero Research, Limited, Duxford, Cambridge. The continuation of technological connections, which have existed between the two companies for a considerable time, is thus assured. Plans for the large-scale expansion of Aero Research, Limited, have already been approved, and both research facilities and production resources will continue to be developed under the control of Dr. N. A. de Bruyne and Mr. R. F. G. Lea.

Obituary

MR. PETER COMBE, formerly of Barclay, Curle & Company, Limited, shipbuilders, of Glasgow, died on April 13.

MR. H. A. DORMER, chairman of the Sheffield Twist Drill & Steel Company, Limited, has died at the age of 67. He was instrumental in introducing the "Schmidt" superheater into Great Britain.

SIR CHARLES JOHN GEOFFREY PALMOUR, who in 1943 was appointed temporary chairman of Harland & Wolff, Limited, to enable Sir Frederick Rebbeck, who was chairman and managing director, to concentrate, in the latter position, on production problems, died in London recently at the age of 71. He was the senior partner of Whinney, Smith & Whinney, chartered accountants.

MR. ROBERT A. WORKMAN, a member of a well-known shipbuilding family, and an underwriting member of Lloyd's, died on April 27 at the age of 75. During his connection with the shipbuilding industry he was on the boards of many well-known firms, including the Fairfield Shipbuilding & Engineering Company, Limited, Glasgow, William Doxford & Sons, Limited, Sunderland, Northumberland Shipbuilding Company, Limited, Workman, Clark & Company, Limited, Monmouth Shipbuilding Company, Limited, and Irvine's Shipbuilding & Dry Docks Company (1930), Limited, West Hartlepool.

SIR WILLIAM REAVELL, founder and managing director of Reavell & Company, Limited, manufacturers of compressors, etc., of Ipswich, died on April 25 at the age of 82. Formerly general manager of the marine department of Babcock & Wilcox, Limited, and general manager of Peter Brotherhood, Limited, it was in 1898 that he decided to set up his own business, which quickly made a considerable reputation. Sir William was president of the Institution of Mechanical Engineers in 1926, and of the British Engineers' Association from 1930 to 1936, and he was also chairman of the general council of the British Standards Institution in the latter year. From 1929 to 1944 he was chairman of the Mechanical Industry Committee, and from 1931 to 1944 chairman of the Engineering Divisional Council.

MR. DAVID FLATHER died on April 21 at the age of 83. He was a life director of W. T. Flather, Limited, manufacturers of alloy and B.D. steel bars, of Sheffield, which was founded by his grandfather. He was elected Master Cutler in 1926, having been a member of the Company since 1911. Before joining the family business in 1886, Mr. Flather was the first to hold the position of metallurgical chemist with John Brown & Company, Limited. He was chairman of W. T. Flather, Limited, from 1918 to 1941, and was made a life director in 1946. Mr. Flather had many interests. At the time of his death he was president of the Bright Steel Bar Association, while he was a former president of the Sheffield Society for the Preservation of Ancient Tools. He was a member of the Sheffield Chamber of Commerce, of the Committee of the Applied Science Department of Sheffield University and of the District Council of the Federation of British Industries. He was also connected with a number of scientific societies. Mr. Flather also had many interests outside of industry—literary, archæological and Masonic. He leaves two sons, Mr. Geoffrey Flather, joint managing director of the company, and Major K. D. Flather, who is a director.

New Companies

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Tungsit Electro Metal Works, 5, Cheapside, London, E.C.2. £12,000.

C. E. Endsor & Company, The Holme, Hawes, Yorks—Agricultural engineers, etc. £3,000. C. E. Endsor and R. Guy.

Stanmacs, Crown Engineering Works, Crown Street, Caernarvon—Engineers. £3,000. L. J. Stanley and D. A. Trew.

Percy Gummer & Sons, 15, Daisy Street, Hopwood Lane, Halifax—General engineers, etc. £6,000. P. and M. Gummer.

F. J. Bullen & Partners, Widemarsh Street, Hereford—Iron and brass founders, etc. £5,000. F. J. Bullen, R. W. A. Tomlinson, C. H. Williams, L. N. Roberts, D. Dawson, H. Cole, and H. J. Waugh.

George H. Baker, The Green, Woodburn Green, Bucks—Scrap iron and metal merchants, etc. £2,500. M. G. Baker, G. B. Matthews, A. C. Small, I. V. Heading, L. M. Hoath, and J. P. Melbourn.

Rowton Engineering Company, 6, Bon Accord Square, Aberdeen—To acquire the goodwill and patents of John L. Rowton & Company, fish industrial engineers, of Aberdeen. £13,000 H. S. and J. L. Rowton, and C. Shaw.

Joseph Beardshaw & Company, Acme Steelworks, Bessemer Road, Sheffield—To take over the business of brassfounders, steel manufacturers and merchants carried on by Arthur M. Beardshaw. £20,000. A. M. and D. H. Beardshaw, and H. Croxen.

Dustarest Company, 159, Cemetery Road, Sheffield—To acquire the interests in inventions relating to the production and manufacture of equipment for use with sanding and grinding machines, etc. £1,000. G. Dale, Jnr., J. R. Billau, and J. W. Robinson.

THE DEATH IS REPORTED in the American Press of Mr. R. H. McCarroll, director of chemical and metallurgical engineering and research for the Ford Motor Company, Dearborn, Mich., and a director of the American Foundrymen's Association. He was well known as a contributor to the technical Press and to the proceedings of the learned society. He was a Master of Engineering, University of Detroit. He was born in 1890 and had been on the staff of the Ford Company since 1915.

Personal

MR. BASIL SANDERSON has accepted an invitation to join the board of the Ford Motor Company, Limited.

MR. G. P. BELSHAM, works manager of Brookhirst Switchgear, Limited, Chester, since 1943, has been elected a director of the company. He will continue to act as works manager.

MR. JOHN FINDLAY, a director of Barnes & Bell, Limited, iron and steel merchants, of Glasgow, has been appointed chairman of the Premier Lamp & Engineering Company, Limited, Leeds.

MR. G. ELLIOTT, who has been in the service of Bamfords, Limited, agricultural engineers, of Uttoxeter, for 30 years, has been elected chairman of the Uttoxeter Urban District Council.

MR. JOHN LANG, Scottish divisional officer of the Iron and Steel Trades Confederation, has been appointed by the Chancellor of the Exchequer to serve on the Scottish Board for Industry.

MAJOR-GENERAL E. P. Readman, a director of the English Steel Corporation, Limited, has been appointed honorary colonel to the R.A.O.C. of the 49th West Riding and Midland Armoured Division.

MR. A. LEIGH, a director of Allott Bros. & Leigh, Limited, boilermakers, constructional engineers, etc., of Rotherham, has been elected president of the Rotherham and District Chamber of Commerce.

MR. J. RAMSAY GEBBIE, managing director of William Doxford & Sons, Limited, shipbuilders, of Sunderland, has been elected a member of the River Wear Commissioners, in succession to the late Mr. T. W. Greenwell.

DR. P. G. GRIFFITH has resigned from the chairmanship of Engineering Components, Limited, Slough, Bucks, for health reasons, but remains a director. MR. C. C. GRIFFITH has been elected chairman of the company.

SIR MARK HODGSON, who is retiring from the general secretaryship of the United Society of Boilermakers and Iron and Steel Shipbuilders, was entertained at dinner by the local district of the Society in Belfast on April 22. Both he and Lady Hodgson received presentations.

MR. ION EARLE is to succeed MAJOR C. R. DIBBEN as Midland regional secretary of the Federation of British Industries. Mr. Earle, who will take up his duties on September 1 next, joined the F.B.I. in 1938 as assistant to Major Dibben in the Federation's Birmingham office. He is 32.

MR. MUNGO CAMPBELL, chairman of Mungo Campbell & Company, Limited, shipowners, of Newcastle-upon-Tyne, has been elected president of the North East Coast Institution of Engineers and Shipbuilders. He was formerly Director of the Shiprepair Division of the Ministry of War Transport.

MR. HORACE W. CLARKE, managing director of James Booth & Company, Limited, non-ferrous tube manufacturers, etc., of Birmingham, has been appointed an additional director of Pinchin, Johnson & Company, Limited, manufacturers of paints, varnishes, etc., of Silvertown, London, E.16, and associated companies.

MR. P. A. H. ELLIOT is relinquishing the position of Director of the Combustion Appliance Makers' Association, which he has held for the past three years, having transferred from the British Coal Utilisation Research Association. He also held the position of secretary to the Coal Industry Fuel Efficiency Committee, joint between the Ministry of Fuel and Power and the Mining Association.

LORD AIREDALE, at present deputy-chairman, is to succeed LORD PERRY as chairman of the Ford Motor Company, Limited. Lord Perry will retain his seat on the board. SIR ROWLAND SMITH, now managing director, is to be deputy chairman, while SIR STANFORD COOPER, a director of the company, is to be vice-chairman. SIR PATRICK HENNESSY, a director and general manager, is to be managing director.

Nickel Activities

In a comprehensive report of the company's activities at the annual meeting of the International Nickel Company of Canada, Limited, on April 28, the chairman and president, Mr. Robert C. Stanley said that work in exploration and development of new uses for nickel progressed steadily, and they believed the trend of consumption would continue to show an upward course. The steel industry continued to be the largest single user of nickel, consuming nearly 50 per cent. of the sales of primary nickel, of which amount over half was used for stainless steels in the United States. The output of stainless steels continued at a high level, with large markets in the food-processing, chemical, petroleum and paper industries, and transportation. Nickel plating demands exceeded the highest annual pre-war consumption by about 8,000,000 lb. In the cast-iron field, some 11,000,000 lb. was consumed in 1947, which was the highest since this development was started some 20 years ago.

Bridge Contract for Middlesbrough

In the face of keen international competition, Dorman, Long & Company, Limited, Middlesbrough, in association with Seth, a Portuguese company, has secured a £1,200,000 contract for the construction of a road bridge over the Tagus at Vila Franca, 20 miles up-river from Lisbon. Competitive tenders were submitted from America, Czechoslovakia, France, Germany, and Sweden. The selected design embodies five steel arch spans each of 340 ft. They will require about 3,000 tons of steelwork, which will be rolled and fabricated on Tees-side.

THE DIRECTORS OF John I. Thornycroft & Company, Limited, engineers, shipbuilders, etc., of London, S.W.1, have decided to form a wholly owned subsidiary under the title of "Transport Equipment (Thornycroft), Limited," to take over the company's road transport interests.

Company News

(Figures for previous year in brackets.)

G. & J. Weir—Final dividend of 30%, making 40% (same).

Walter Spencer & Company—Interim dividend of 5% (same).

Perry & Company (Holdings)—Interim dividend of 2½% (same).

Pressed Steel Company—Final dividend of 20%, making 30% (same).

Ransomes & Rapier—Final dividend of 5%, making 7%, tax free (same).

Banks & Davis—Final dividend of 25% (50%), making 100% (same).

Craven Bros. (Manchester)—Final dividend of 10% (15%), making 15% (20%).

Hudson & Wright—Dividend of 40%. The company was made public in June, 1947.

Sanderson Bros. & Newbould—Final dividend of 5% on larger capital (5%), making 10% (same).

Telegraph Condenser Company—Final dividend of 10% (10% and bonus of 5%), making 15% (same).

Saunders Valve Company—Interim dividend of 5% in respect of the initial period to April 30, 1948. It is the board's intention to recommend this as a final dividend.

Chloride Electrical Storage Company—Final dividend of 5% and bonus of 10%, making 20% on the "A" and "B" ordinary stock for the nine months to December 31, 1947 (same for year).

Smith & McLean—Net profit for 1947, £78,972 (£74,780); reserve not required, £1,306 (£3,223); to reserve, £30,000 (£10,000); dividend of 15% (11%) and bonus of 10% (9%); forward, £182,061 (£162,720).

Ever Ready Company (Great Britain)—Final dividend on the 7% cumulative participating preference shares of 5%, making 10% (same); and final dividend of 25% on the ordinary shares, making 40% (same).

Engineering Components—Net profit for 1947, £34,647 (£30,561); to dividend equalisation reserve, £25,000 (nil); final dividend of 15% and bonus of 5%, making 30% (same); forward, £15,477 (£28,930).

Power Securities Corporation—Gross profit for 1947, £139,322 (£128,313); to expenses, £13,769 (£12,161); fees, £1,200 (same); profits tax, £7,100 (£2,150); net balance, £117,253 (£112,802); income tax, £55,129 (£49,774); general reserve, £20,000 (same); dividend of 6% (same); forward, £54,003 (£57,529).

F. McNeill & Company—Net profit for 1947, after depreciation, etc., £87,958 (£52,466); to tax, £18,761 (£29,961); Government costing claim, £23,548 (nil); capital increase costs, nil (£1,731); general reserve, £25,000 (£10,000); final dividend of 10% (same), making 20% (15%); forward, £23,506 (£16,778).

Charles Neil & Company—Trading profit for 1947, £24,368 (£20,773); to depreciation, £632 (£864); directors' remuneration and commission, £4,334 (£3,955); tax, £10,582 (£8,567); net profit, £8,819 (£7,387); final dividend of 25%, making 50%, tax free (same); building reserve, £1,500 (nil); forward, £8,302 (£7,183).

Derbyshire Stone—Revenue in 1947, £63,922 (£70,183); to depreciation, £5,233 (£2,600); tax, £24,692 (£25,439); directors' fees, £2,000 (£1,900); general administration, £1,000 (same); audit fee, £105 (same); profit, £30,892 (£39,139); to preference issue expenses, nil (£7,957); preference dividends, £13,859 (£6,443); ordinary dividend of 12½% (same); forward £104,622 (£102,233).

Drakes—Trading profit for 1947, £49,798 (£38,454); income from investments, £56 (£77); transfer fees, £2 (£1); to bank interest, etc., £2,569 (£2,744); depreciation, £3,272 (£2,474); directors' fees, £200 (same); taxation, £19,000 (£18,000); net profit, £24,815 (£15,114); to revenue reserve, £10,000 (£5,000); dividend of 10% (same) and centenary bonus of 10% (nil); forward, £25,833 (£20,618).

W. Canning & Company—Trading profit for 1947, £477,375 (£320,304); income from investments, £2,377 (£3,270); transfer fees, £49 (£34); to directors' fees, part year, nil (£20); depreciation, £39,373 (£26,554); pensions and benevolent fund, £15,000 (nil); net profit, £425,428 (£297,034); to tax, £243,986 (£179,316); general reserve, £125,000 (£25,000); contingencies and rehabilitaion costs, nil (£25,000); dividend and bonus of 27½% (same); staff fund, nil (£10,000); forward, £89,790 (£78,723).

British Oxygen Company—Profit for 1947, including dividends from subsidiary companies, £2,256,127 (£1,596,599); other income, £22,532 (£4,935); to depreciation, £474,537 (£489,807); special depreciation reserve, £80,000 (nil); pension funds, £60,318 (£90,269, including £40,238 special consolidation of war bonus contribution); directors' fees, £2,600 (same); tax, £939,621 (£500,000); net profit, £721,583 (£668,858); final dividend of 12%, making 20% (same); reserve, £250,183 (£200,818); forward, £123,693 (£100,389).

C. & W. Walker—Trading profit for the year to January 31, £48,665 (£32,438); dividends from subsidiary company, £2,220 (£3,195); other dividends and transfer fees, £1,130 (£1,098); to profits tax, £7,000 (£1,420); reserve income tax, £16,777 (£12,731); depreciation, £6,625 (£5,266); deferred repairs, £4,329 (£3,219); directors' fees, £600 (same); directors' additional remuneration, £1,284 (£1,002); net profit, £15,400 (£12,493); dividend and bonus of 15% (12½%); contingency reserve, £5,000 (£3,342); forward, £19,358 (£18,511).

Vulcan Foundry—Manufacturing profit for 1947, £202,946 (£360,394); rents, £547 (£987); income from investments, £12,180 (£9,302); to depreciation, £38,863 (£48,873); directors' fees, £5,000 (same); interest on deposits by workmen under participating investment scheme, £484 (£371); net profit, £171,326 (£316,439); trade investment dividend in respect of 1946, £9,546 (nil); to profits tax, plus E.P.T. for periods prior to 1947, £112,473 (£227,439); general reserve, £35,000 (£50,000); dividend of 5% (same) and bonus of 1½% (same); forward, £52,257 (£51,820).

Parkinson & Cowan—Consolidated gross profit for 1947, £243,254 (£180,533); to debenture service, depreciation, fees, allowances, taxes and repairs, £170,575 (£127,473), leaving £72,679; profit on sale of sundry assets, £11,145 (£4,981); written off goodwill and patents, £2,300 (nil); equity of outside holders, £985 (nil); preference dividend, £18,630 (£17,784); ordinary dividend of 5% (same); surplus, £41,948 (£19,061); to reserve, £10,000 (nil); to increasing carry-forward in subsidiaries, £26,333 (£15,770); addition to carry-forward, £5,615 (£3,291); undivided profits of group carried forward, £117,472 (£85,524).

English Steel Corporation—Total profit for 1947, £1,442,258 (£993,814); to depreciation, £400,000 (£398,754); taxation, £563,869 (£225,167); balance, £326,918 (£301,929); to surpluses placed to reserve, £14,617 (£2,371); debenture sinking fund, £24,993 (£23,578); dividends, £283,758 (same); forward, £193,937 (£190,387). Amount of £3,817,530 consisting of £2,075,000 provisions not required, £800,000 E.P.T. deficiency not previously brought to account, and £942,530 special distributions by subsidiaries, was paid in form of special interim dividend, free of tax, to Vickers, Limited, and Cammell Laird & Company, Limited.

Textile Machinery Makers—Dividends from subsidiary companies for 1947, £632,328 (£105,295); dividends from trade investments, £2.438 (£3,538); bank interest, £505 (£74); interest on loan to subsidiary company, £87 (£98); interest on tax-reserve certificates, £3,084 (£7,032); transfer fees, etc., £4 (£248); to salaries and expenses, £34,409 (£31,823); directors' fees, £23,154 (£4,472); loan interest, £15,762 (£249); leaving £565,121 (£79,741); to profits tax, £81,573 (nil); income tax, £216,805 (£79,519); net profit, £266,743 (£103,717); to under-provision for tax in previous accounts, £9,090 (£12,122); dividend of 6% (same); forward, £266,313 (£117,749).

Thos. Firth & John Brown—Trading balance for 1947, £704,987 (£769,939, including previous year's adjustments, subsidiaries and investments income, E.P.T. recoverable, and after income tax); income from subsidiary companies and investments, £199,469; profit from wartime contracts adjustments, £100,816; to directors' fees, £3,417 (£3,485); debenture, mortgage and loan interest, £47,026 (£47,290); depreciation, £152,172 (£173,103); tax, £364,362; net profit, £438,295 (£546,061); second interim dividend of 7½%, making 10%, tax free (same); deferred repairs and A.R.P. removal reserve, nil (£300,000); forward, £590,850 (£350,755).

Associated Electrical Industries—Trading profit for 1947, £1,933,210 (£1,062,915); dividends, etc., from subsidiary companies, £1,272,599 (£1,137,634); other dividends and interest, £110,610 (£52,037); profit on sale of miscellaneous assets, £10,581 (£29,068); to depreciation, £298,611 (£226,861); to directors' fees, £7,000 (£8,050); reserves, £100,249 (£29,068); other provisions, £176,883 (£94,463); provision for taxation, £1,582,249 (£827,166); net profit, £1,162,008 (£1,096,046); withdrawn from fuel crisis reserve, £63,305 (nil); to general reserve, £547,475 (£200,000); final dividend of 7½% and bonus of 2½%, making 15% (same); forward, £411,792 (£344,400).

Cammell Laird & Company—Trading profit for 1947, after providing for depreciation and taxation and writing down Government stocks, £218,971 (£248,519); income from investments, etc., £165,097 (£150,057); transfer fees, £503 (£593); to debenture service, £22,292 (£21,992); directors' fees, £3,500 (£3,100); net profit, £358,779 (£374,077); to general reserve, £151,634 (£200,000); final dividend of 7½% (8½%), making 12½%, less tax (same) and bonus of 3%, tax free (same); forward, £158,124 (£126,260). Special dividend of £1,348,366 received from the English Steel Corporation, Limited, arising from reserves and provisions surplus to requirements, has been transferred to general reserve.

Vickers—Dividends and interest from subsidiary companies, less expenses, for 1947, £1,853,240 (£1,654,506); income from investments in associated companies, £138,437 (£109,687); income from trade investment, £189 (nil); income from other investments, £229,924 (£235,717); interest on bank balances and tax reserve certificates, etc., £30,572 (£16,453); to directors' fees, £12,586 (£13,900); interest on 4 per cent. first mortgage debenture stock, £34,756 (£35,581); income tax, £979,782 (£890,658); net profit, £1,225,238 (£1,076,224); to sinking fund for redemption of 4 per cent. first mortgage debenture stock, £21,444 (£20,620); contingencies reserve, nil (£250,000); final dividend of 8½%, making 12½% (same); forward, £1,570,488 (£1,123,001).

Hadfields—Trading profit for 1947, including miscellaneous income and after deducting expenses and maintenance, £381,071 (£149,053); claims in connection with Iron and Steel Prices Fund agreement, £50,000 (£224,367); dividends and interest received, £21,726 (£27,449); sundry non-recurring income, £8,054 (nil); transfer fees, £215 (£196); to tax, £160,000 (£143,000); depreciation, £85,062 (£66,284); deferred repairs, £50,000 (nil); pensions, £17,525 (£18,004); directors' fees, £6,200 (£6,100); debenture interest and fees, nil (£8,825); net profit, £142,279 (£158,852); final dividend of 12½%, making 17½% (17½% and bonus of 2½% not subject to tax paid out of capital reserve); dividend equalisation reserve, £250,000; deferred repairs reserve, £250,000; staff pensions, £100,000; forward, £338,982 (£907,906).

Newton Chambers & Company—Profit for 1947, £290,686 (£255,920); income from Thorncliffe Coal Distillation, Limited; dividend arrears, nil (£31,467), current dividend, £36,398 (£46,259); trade investments, £18,868 (£21,683); Government investments, £2,094 (£4,178); to depreciation, £53,818 (£45,284); interest on notes, £1,852 (£2,784); directors' fees, £5,775 (£6,850); salaries and superannuation, £10,508 (£10,998); net profit, £280,068 (£298,908); to tax, £151,492 (£165,979); notes reserve, £30,000 (same); social facilities, £10,000 (same); welfare, £10,000 (nil); pensions, nil (£50,000); final dividend of 10%, making 15% (same plus "end-of-war" bonus of 10%); forward, £157,968 (£129,958). As previously announced, a capital cash bonus of 9.855% was paid from net capital appreciation on shares sold prior to 1943.

Raw Material Markets

Iron and Steel

Pig-iron production has been raised to an exceptionally high level and, if there is still a shortage, it is due to the unusually heavy demand. A record output of 3,200,000 tons of iron castings is forecast for the current year. This obviously implies confidence that supplies of pig-iron will be further increased, since current deliveries fall short of requirements. The melting shops are now fairly well supplied with basic iron and, at the foundries, the deficiency in the supply of high-phosphorus iron is more marked than in the case of other grades. Blast-furnace men need more coke before any more units can be put into operation.

The United States is still the principal contributor to Britain's intake of semi-finished steel, and further aid is envisaged in the Marshall plan. But to a greater extent than ever before, British re-rollers are reliant upon home supplies. Deliveries are certainly substantial and the position in regard to heavy blooms and slabs is not unsatisfactory, but the execution of the immense volume of orders for light sections and sheets calls for still bigger tonnages of small billets and sheet bars, for which there is a clamant demand.

Under the new system of authorisation, orders for finished steel for delivery during the current period are more closely related to production capacity, and it is hoped to impose an effective check upon the tendency to seek licences in excess of actual requirements. Producers have no anxieties about the maintenance of the mills in full production and inquiries from overseas for sheets, plates, bars and rails are exceptionally heavy. Shipbuilders have fared better than was expected, but a bigger proportion of the output of rails has been allocated to the export trade. Tubemakers and builders of locomotives and wagons are exceptionally busy, while wire mills are also fully booked for the current period.

Non-ferrous Metals

Although the United States continues to import copper freely from Latin America and Mexico to bridge the gap between domestic consumption and production, there is probably also a modest export business being done by Chile. The mines there are American owned and payment for copper sent to Europe must be made in U.S. dollars, which militates against any great volume of trade. Since the end of the war the Chilean brands, so popular in this country prior to the outbreak of hostilities in 1939, have reappeared, but, naturally, the Ministry of Supply has tried, so far as possible, to concentrate on the products of mines in the sterling area requiring payment in soft currencies. This has kept imports from Latin America down to a minimum, but it seems that some copper will have to be accepted from South America in order to balance the U.K. metal budget this year. Chile can furnish three grades of copper, *viz.*, blister, fire-refined, and electrolytic, all of proved quality and eminently suitable for use in our metal-fabrication plants. If further quantities are secured, now that E.R.P. is in being, there will be nothing but satisfaction in the minds of consumers in this country. Overall stocks of copper in the U.K. seem to be adequate, but some types are in better supply than others and, as always, demand for certain shapes is more marked. However, as a whole, the situation is fairly satisfactory.

Scrap, the barometer of the non-ferrous metal situation in the absence of a futures market, has of late been showing some irregularity, for despite the distinctly firm tendency of the virgin metals, values of secondary metals are showing an inclination to fall. The reason for this is the pressure to sell by holders, who seem to be suffering from an attack of "nerves." The cause lies in the fact that, unlike the controlled price situation obtaining in virgin metals where the Ministry of Supply is the sole seller and therefore enjoys a monopoly, the scrap-metal market is sensitive to every change in the situation, and at the moment there is some falling off in activity in the ranks of the fabricators. Moreover, there is an increasing realisation of the fact that the general public is at long last "digging its heels in" and refusing to pay the inflated prices at which goods are now offered. In non-ferrous metals, prices are high—dangerously so—and the scrap merchants, or some of them at any rate, are determined to reduce their holdings.

News in Brief

WELDED INDUSTRIAL COMPONENTS, LIMITED, London, E.C.4, has changed its name to Welincom, Limited.

PLANS ARE being considered for the building of an engineering block for King's College, Newcastle-upon-Tyne.

THE MULLARD WIRELESS SERVICE COMPANY, LIMITED, will in future be known as Mullard Electronic Products, Limited.

THE DISTRICT HEAT & ENGINEERING COMPANY, LIMITED, Birmingham, has changed its name to Wynn (Products), Limited.

BRITISH TIMKEN, LIMITED, has received the approval of the Ministry of Supply for extensions to its Duston factory, Northampton.

BLACKDOWN COMPANY, LIMITED, dealers in metals, machinery, etc., of London, E.C.2, has changed its name to Avia Britannica Corporations, Limited.

THE BRITISH COLOUR COUNCIL has announced that H.R.H. Princess Elizabeth has consented to become Patron of the Council in succession to the late Earl of Derby.

LONG-SERVICE AWARDS were presented to employees of the Premier Lamp & Engineering Company, Limited, Leeds, at a dinner held to celebrate the 35th anniversary of the company.

OWING TO the incidence of the Whitsun holiday the British Industries Fair, London and Birmingham, will close at 4 p.m. on May 14, instead of at 6 p.m. as previously announced.